

What Accounts for Differences in State Export Performance? Evidence from the Heartland, 1996-2000

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Introduction

Between 1996 and 2000, Indiana exports increased by 40%. That was a pretty good performance considering that exports from all 50 states increased by 25% over that same time period. Benchmarking Indiana against 12 other states in or contiguous to America's Heartland (in Table 1), reveals a considerable variance in net relative change. (NRC is defined as the difference between a state's export sales growth and the nation's export sales growth between 1996 and 2000.) Indiana's NRC value of 15 (15 points above the national average growth rate for export sales) was the third largest among these states. Kentucky topped this group with an NRC value of 25; Iowa had the smallest NRC value, -24.

Table 1. Net Relative Change, 1996-2000

<u>State</u>	<u>NRC</u>
Kentucky	25
Tennessee	18
Indiana	15
Pennsylvania	6
Illinois	5
Arkansas	4
New York	0
Michigan	-2
Missouri	-5
Ohio	-9
Wisconsin	-15
Mississippi	-21
Iowa	-24

What accounts for these differences in export sales growth across states? Cletus C. Coughlin and Patricia S. Pollard (C&P)¹ analyzed these differences for all 50 states for the 10-year time period from 1988 to 1998. C&P concluded that the competitive effect “is the key determinant of whether a state's export sales grew more or less rapidly than the national average...prior research suggests one possible economic explanation for this result: that those states with larger increases in human capital per worker have seen their industries outperform the corresponding national industries in terms of export growth.”² **See the Technical Appendix for a more complete explanation of C&P's methods.**

In C&P's analysis, the “competitive effect” was defined in terms of how specific state export industries fared relative to their national counterparts. While C&P's conclusion is well taken, their narrow methodology leads them to minimize the importance of country destination as it relates to a state's export sales growth. Inasmuch, their method biased their results.

Our approach shows that export success goes beyond industry-centered effects and is related to both past and present efforts to enter foreign markets. Surely both national and state government efforts to assist U.S. firms could affect state export sales gains. State private and government efforts to

facilitate market entry may be behind our results that showed a much larger role for export destinations in explaining NRC. We followed the general methodology used by C&P, tweaked it a little, and applied it to the 1996-2000 time period.³ This allowed us to isolate and identify the importance of the following contributions to a state's NRC value:

- Export Industry versus Country Destination
- National Coattails versus State-Specific effects
- State-Specific Industry effects: Coattails versus State Industry-Specific effects

National Coattail Effects

National “Coattails” implies that one reason a state might have had an export sales growth rate that significantly differed from the nation's growth rate is because, in 1996, the state was well positioned in industries or experienced in country destinations that deviated from the overall national export sales pattern. For example, U.S. export sales of Pharmaceuticals grew faster than exports of all U.S. industries from 1996 to 2000. Because Indiana was well positioned in Pharmaceutical exports – a large share of Indiana's total exports in 1996 were Pharmaceuticals – Indiana benefited from the Coattail effect of strong national Pharmaceutical export sales.⁴ Coattail effects can also relate to country destinations – because Indiana was well positioned with export sales to Canada in 1996, and because U.S. exports to Canada grew relatively rapidly, Indiana benefited from the national export growth to Canada.⁵ **Table 6 in the Tables Appendix shows the growth rates of exports from the U.S. of selected industries and country destinations.**

State-Specific Effects

A state's NRC might not be driven by these National Coattails but instead be derived from factors specific to the state's industries and country destinations. Indiana's exports to Mexico from 1996 to 2000 grew much faster than U.S. exports to Mexico, contributing to Indiana's +15 NRC. Similarly, Indiana's exports of Vehicles grew faster than U.S. exports of Vehicles, explaining the state's above-national export sales growth rate. (C&P called this the “competitive effect.”) In our more general model there are actually two such effects instead of one. One relates to industries, the other one to country destinations.

State-Specific Industry Effects

Finally, the State-Specific Industry effect can be further decomposed. For example, Indiana exports of Vehicles grew much faster than the nation's exports of Vehicles between 1996 and 2000. This might be the result of Indiana's workforce, its capital, or its infrastructure. However, it might also be explained by where Indiana Vehicles were exported. This further breakdown shows that Indiana's Vehicles exports were strong because Indiana Vehicles export sales growth between 1996 and 2000 was much stronger to Mexico than to other country destinations. Partially offsetting this effect was the fact that Canada was a strong export destination for Indiana in 1996 but exports from all Indiana industries to Canada did not keep pace with exports of all Indiana industries to other countries.

Summary

Our analysis examined Indiana and 12 other states with respect to export sales growth relative to the nation between 1996 and 2000. Our main finding is that these states had very different experiences because of both National Coattails and State-Specific effects. These experiences depended in varying degrees on their mix of export industries and sales experiences with country destinations.

Indiana Summary

We can explain Indiana's NRC of +15 with six facts:

- (1) National exports to **Canada** were strong, and Indiana was well positioned in Canada in 1996.
- (2) National exports of **Pharmaceutical goods** were strong, and Indiana was well positioned with Pharmaceutical goods exports in 1996.
- (3) Indiana exports to **Mexico** grew faster than national exports to Mexico between 1996 and 2000.
- (4) Indiana exports of **Vehicles** grew faster than national exports of Vehicles between 1996 and 2000.
- (5) Indiana exports of Vehicles were strong because Indiana Vehicles exports to **Mexico** grew faster than Indiana exports of all goods to Mexico.
- (6) Indiana exports of Vehicles were weak because Indiana exports of all goods were well positioned in **Canada** in 1996, and Indiana exports to Canada grew slowly between 1996 and 2000.

General Summary

- Of the 13 states we examined, three had very high NRC values, four had very low NRC values, and the remaining six had NRC values between + 6 and -5. Indiana was among the three states whose exports grew much faster than the nation's exports.
- National Coattails versus State-Specific effects

We see significant differences among these states with regard to the relative roles played by National Coattails and State-Specific effects but note that State-Specific effects were of greater importance for nine of the 13 states. Both effects played strong roles in Indiana. See **Table 2 in the Tables Appendix for details**. For Kentucky and Tennessee the State-Specific effects boosted exports. For Missouri and Ohio, in contrast, they detracted from export growth. National Coattails were important sources of growth for Pennsylvania and Illinois.

- National Coattails: Country Destinations versus Industry

While National Coattails were the most important determinants of NRC in three of the 13 states, they played some role for all of these states. See **Table 3 in the Tables Appendix** for more details.

- For six of the states, the country and industry influences were relatively equal in determining Coattail effects. Industry effects dominated in five states. Destination effects were dominant only for Michigan and Wisconsin.
- Indiana stands out as the only state with a positive NRC and relatively equal and reinforcing destination (Canada) and industry (Pharmaceutical) effects. Mississippi

also had relatively equal and reinforcing Coattail effects, albeit negative ones, because it was well positioned in Russia and Meat, two export indicators that did very poorly at the national level.

- Five states had slower-than-national export growth because Vehicle exports grew slowly for the nation. Three had faster-than-national export growth because U.S. Electrical Machinery exports did well between 1996 and 2000.

- State-Specific effects: Country Destinations versus Industry

While State-Specific effects were of greater or equal importance for nine states, they played some role for all these states. To what extent were the State-Specific impacts generated by a state's unique industry mix? To what extent were they determined by country destination mix? See Table 4 in the Tables Appendix for more details.

- We found that for the seven states with the largest differences from the nation (those with the highest absolute NRC values), they all had relatively equal contributions from Country Destination and Industry effects.
- Japan, Mexico, and Canada were important determinants of State-Specific effects in 10 of the 13 states. These three countries were important for state exports growing both faster and slower than the nation's exports.
- Vehicles and Machinery were the key industries for these 13 states.
- Vehicles and Machinery were the key industries largely because of their export experiences with Canada and Mexico, respectively.
- For Indiana, very strong global growth of Vehicles and rapid export growth of all Indiana's exports to Mexico shared somewhat equally in Indiana's State-Specific effect. Vehicles growth was largely determined by success in Canada and Mexico.

- State Industry Coattails versus State Industry-Specific effects

For each state, we selected one industry that was responsible for its State-Specific Industry effect. This is the industry most responsible for its export sales growth being faster or slower than the nation's. For each of the states, we examined the importance of location for the selected industry. Two types of locations were analyzed:

State Coattails: destinations that were important for all the state's industries
State Specific: destinations that were important only for the selected industry

- The upshot from these 13 states is that the primary country destination factor was State Specific (not State Coattails) to a particular industry. What mattered most for an industry's impact was that its export performance from 1996 to 2000 was better (or worse) than other state industries to particular countries. What mattered least to key industries was how well positioned all the state's industries were in 1996 to a particular country that was important for all the state's export industries.
- That is, just because Canada was a major export destination for Indiana in

1996, that situation was not the key to export success from 1996 to 2000. If, say, Indiana Vehicles makers had strong export growth from 1996 to 2000 it was because they plowed new territory (to Mexico) and not because Canada was a good place for Hoosiers to do business. In fact, the negative sign for the State Coattails effect for Indiana says that all Indiana exporters did poorly with respect to export sales growth to Canada between 1996 and 2000.

- In Tennessee and Mississippi, the same country destination – Mexico – was responsible for both the State Specific and State Coattails effects. For Tennessee that meant that Mexico was a poor location for all Tennessee industries but that it was an especially good one for Tennessee’s Electrical Machinery exporters between 1996 and 2000. For Mississippi it meant that Mexico was a good location for all Mississippi industries but an especially poor destination for Mississippi’s Machinery exporters.
- Canada and Mexico are the most frequent country destinations found in Table 5. Except for Kentucky Machinery, Canada was mostly a negative factor for these states. Mexico, in contrast, was generally a positive factor for these states, except for Mississippi.

Tables Appendix

Introduction

The numbers in each of the following tables represent decompositions of NRC values for each state. These numbers, therefore, have similar scales and can be compared directly to NRC values. For example, in Table 2 Indiana’s NRC value of 15 has been decomposed into scores of nine for State-Specific effects and six for National Coattails effects. It would be correct to say that State-Specific effects accounted for 75% of NRC.

While the numbers in Table 2 add up (except for rounding in some cases) to the NRC for each state, this is not true for Tables 3 and 4. Nevertheless, the numbers are scaled the same and can be compared in size. The equations used to determine all these numbers are contained at the end of the report.

Table 2.

Table 2. National Coattails versus Industry-Specific Effects, 1996-2000

<u>State</u>	<u>Total</u>	<u>State-Specific</u>	<u>National Coattails</u>	<u>Tendency</u>
Kentucky	25	25	0	State-Specific
Tennessee	18	18	0	State-Specific
Indiana	15	9	6	Relatively Equal
Pennsylvania	0	0	6	Coattails
Illinois	5	0	5	Coattails
Arkansas	4	11	-7	Relatively Equal
New York	0	-4	4	Relatively Equal
Michigan	-2	-9	7	Relatively Equal
Missouri	-5	-6	1	State-Specific
Ohio	-9	-9	0	State-Specific
Wisconsin	-15	-10	-5	Relatively Equal
Mississippi	-21	-3	-18	Coattails
Iowa	-24	-16	-8	Relatively Equal

Note: The State-Specific effect shown in Table 2 column 3 is the difference between the Total and National Coattails effects. It is not the sum of the State-Specific Industry and State-Specific Country Destination effects. See the third component of equation (2) below for the exact definition of the State-Specific effect.

Table 2 compares Indiana to 12 other states with respect to the roles played by National Coattails and State-Specific effects. We see significant differences among these states and note that Coattails to the national economy were the greater effect in three states and of significant importance for nine of the 13 states.

Four states' NRC values were predominantly determined by State-Specific effects.

Three states' NRC values were predominantly determined by National Coattail effects.

Three states' NRC values were the result of offsetting balanced factors.

Three states' NRC values were the result of reinforcing but balanced factors.

Table 2 shows that Indiana was very balanced relative to the other states, with high and relatively equal scores for both Coattail (NRC=6) and State-Specific (NRC=9) effects. Other states with balanced tendencies included Arkansas, New York, Michigan, Wisconsin, and Iowa. Notice that these balanced tendencies can be reinforcing or offsetting. They tended to be offsetting for those states with less extreme NRC values. The best example is New York. New York's NRC value of zero was the result of a negative 4 value for State-Specific effects and a positive 4 value for the Coattails effect. This means that New York was well positioned (with the right industries to the right countries) to do well in 1996 but its state industries generally under-performed their national counterparts. Indiana and Wisconsin had relatively balanced and reinforcing contributions from State-Specific and Coattail effects for their respective NRC values of +15 and -15.

Table 3.

Table 3. National Coattail Effects: Country Destination and Industry, 1996-2000

<u>State</u>	<u>Total</u>	<u>Destination</u>	<u>Industry</u>	<u>Tendency</u>		
Kentucky	0	1	-1	Relatively Equal	Canada	Vehicles
Tennessee	0	2	-2	Relatively Equal	Mexico	Vehicles
Indiana	6	3	4	Relatively Equal	Canada	Pharmaceuticals
Pennsylvania	6	1	5	Industry	NA	Electrical Machinery
Illinois	5	-1	6	Industry	NA	Electrical Machinery
Arkansas	-7	1	-9	Industry	NA	Cereals
New York	4	-2	6	Industry	NA	Electrical Machinery
Michigan	7	10	-3	Destination	Mexico	NA
Missouri	1	5	-4	Relatively Equal	Mexico	Vehicles
Ohio	0	1	-1	Relatively Equal	Canada	Vehicles
Wisconsin	-5	-4	-1	Destination		NA
Mississippi	-18	-10	-8	Relatively Equal	Russia	Meat
Iowa	-8	-1	-7	Industry	NA	Vehicles

Table 3 examines the country and industry influences on the Coattail effects. For six of the states, the country and industry influences were relatively equal in determining Coattail effects. Industry effects predominated in five states. Destination effects were dominant only for Michigan and Wisconsin. Indiana stands out as the only state with a positive NRC and relatively equal and reinforcing destination (Canada) and industry (Pharmaceutical) effects. Mississippi also had relatively equal and reinforcing Coattail effects because it was well positioned in Russia and Meat, two export indicators that did very poorly at the national level. Five states did poorly because Vehicles exports grew slowly for the nation. Three states did well because U.S. Electrical Machinery exports did well between 1996 and 2000.

Table 4.

Table 4. State-Specific Effects: Country Destination and Industry, 1996-2000

<u>State</u>	<u>Total</u>	<u>Destination</u>	<u>Industry</u>	<u>Tendency</u>		
Kentucky	25	24	26	Relatively Equal	Japan	Machinery (UK, Canada)
Tennessee	18	16	20	Relatively Equal	Mexico	Electric Machinery (Mexico, Mexico)
Indiana	9	12	11	Relatively Equal	Mexico	Vehicles (Canada, Mexico)
Pennsylvania	0	5	1	Destination	Canada	NA
Illinois	0	6	-1	Destination	Canada	NA
Arkansas	11	2	13	Industry	NA	Meat (Hong Kong, Russia)
New York	-4	2	-6	Industry	NA	Precious Stones (Switzerland, UK)
Michigan	-9	-13	1	Destination	Mexico	NA
Missouri	-6	-10	-1	Destination	Canada	NA
Ohio	-9	-10	-8	Relatively Equal	Japan	Vehicles (Japan, Canada)
Wisconsin	-10	-11	-13	Relatively Equal	UK	Vehicles (Saudi Arabia, Canada)
Mississippi	-3	-11	-14	Relatively Equal	Russia	Machinery (Mexico, Mexico)
Iowa	-16	-23	-17	Relatively Equal	Japan	Vehicles (France, Canada)

Note: The numbers in columns 3 and 4 do not necessarily add or average to the total State-Specific effect. See equations below for details.

Table 4 looks at State-Specific effects. Notice that for the seven states with the largest differences from the nation (those with the highest absolute NRC values and at the top and bottom of Table 4), they all had relatively equal contributions from Country Destination and Industry effects. For the remaining six states “in the middle” the State-Specific effect was the more important determinant for four states. For two states, industry was more important.

This table also lists the countries and industries most responsible for these values. Japan, Mexico, and Canada were important in 10 of the 13 states (next-to-last-column). Notice that these three countries were important for state exports growing both faster and slower than the nation’s exports. Vehicles and Machinery were the key industries.

In the far right-hand column of the above table is the industry in each state whose export sales growth was significantly different relative to the same industry in the nation. For example, Indiana Vehicles industry export sales growth was much greater than the national Vehicles industry export sales growth from 1996 to 2000.

In parentheses in the last column are the countries that best explain why the industries in the last column outperformed other state export industries. Two countries are listed because there are two ways in which country destinations impacted each industry’s sales growth. First, all the state’s industries may have had rapid (or weak) export sales growth to a particular destination. If the industry mentioned in the last column was well positioned in that country destination in 1996, then that industry would have had “industry-specific coattails” to all the state’s industries to that destination. Second, between 1996 and 2000, a particular destination for the industry mentioned in the last column may have had stronger (or weaker) export sales growth than other industries in that

state. Why did Indiana Vehicles export sales grow faster than U.S. Vehicles export sales? We find Indiana Vehicles did better because:

- (1) The state was well positioned in Canada with respect to all its export industries and Vehicles were pulled along by Indiana's good general access to our northern neighbor; and
- (2) Indiana Vehicles exports to Mexico grew considerably faster than Indiana exports of all goods to Mexico.

Notice that these countries mentioned in the last column of Table 4 can be different from those in the next-to-last column. Use Kentucky as an example. Japan was important to Kentucky's rapid export growth because Kentucky's exports of all goods to Japan grew more rapidly than U.S. exports to Japan. The UK and Canada, however, were important because these destinations were very important for Kentucky's leading export industry, Machinery.

Table 5.

Table 5. Industry Country State Coattails versus Industry Country State-Specific Effects, 1996-2000

<u>State</u>		<u>State-Specific Industry</u>	<u>State Coattails</u>		<u>State Specific</u>	
Kentucky	26	Machinery	4	UK	70	Canada
Tennessee	20	Electrical Machinery	2	Mexico	70	Mexico
Indiana	11	Vehicles	-9	Canada	18	Mexico
Pennsylvania	1	Optic/Medical Instr	0	Canada	63	UK
Illinois	-1	Electrical Machinery	-16	S. Korea	-22	Canada
Arkansas	13	Meat	-10	Hong Kong	14	Russia
New York	-6	Precious Stones	3	Switzerland	-17	UK
Michigan	1	Electrical Machinery	-2	Thailand	20	Mexico
Missouri	-1	Aircraft/Spacecraft	-54	Finland	-24	Germany
Ohio	-8	Vehicles	-2	Japan	-18	Canada
Wisconsin	-13	Vehicles	-15	Saudi Arabia	-28	Canada
Mississippi	-14	Machinery	41	Mexico	-34	Mexico
Iowa	-17	Vehicles	1	France	-23	Canada

Note: The numbers in columns 4 and 6 do not add or average to the numbers in column 2. This results because of the lack of matching of country destinations for all of a state's export industries and for one of its industry sectors.

Six of these states have positive values in the second column. For these six states, the State-Specific Industry effect was greater than zero, meaning that the industry named in column 3 was an important export industry in that state, and its exports from that state grew faster than the same industry from all 50 states. For all six of those states, the State-Specific effects were dominant and greater than zero. In half of these six states the State Coattails effect was less than zero but not large enough to offset the positive State-Specific effects. In the other three states the two effects were reinforcing. Mexico was a very important destination for Electrical Machinery and Vehicles among these states. Canada was a strong destination for Machinery; the United Kingdom for Medical Instruments; and Russia for Meat.

The seven remaining states had negative values in the second column implying that the industry named in column 3 was important, but its exports from that state grew slower than the same industry from all 50 states. For all but one (Missouri) of these seven states, the State-Specific effects dominated the State Coattails effects. Slow export sales growth of Vehicles and Electric Machinery explained slower than national growth for four of these states. Canada was involved in most of these cases.

The upshot from these 13 states is that the primary country destination factor was State Specific (not State Coattails) to a particular industry. What mattered most for an industry's impact was that its export performance from 1996 to 2000 was better (or worse) than other state industries to particular countries. What mattered least to key industries was how well positioned all the state's industries were in 1996 to a particular country. That is, just because Canada was a major export destination for Indiana in 1996, that situation was not the key to export success from 1996 to 2000. If, say, Indiana Vehicles makers had strong export growth from 1996 to 2000 it was because they plowed new territory (to Mexico) and not because Canada was a good place for Hoosiers to do business. In fact, the negative sign for the State Coattails effect for Indiana says that all Indiana exporters did poorly with respect to export sales growth to Canada between 1996 and 2000.

In Tennessee and Mississippi, the same country destination – Mexico – was responsible for both the State Specific and State Coattails effects. For Tennessee that meant that Mexico was a poor location for all Tennessee industries but that it was an especially good one for Tennessee's Electrical Machinery exporters between 1996 and 2000. For Mississippi it meant that Mexico was not a good location for all Mississippi industries and an especially poor destination for Mississippi's Machinery exporters.

Canada and Mexico are the most frequent country destinations found in Table 5. Except for Kentucky Machinery, Canada was mostly a negative factor for these states. Mexico, in contrast, except for Mississippi, was generally a positive factor for these states.

Table 6.

Percentage Change U.S. Exports 1996-2000

All industries/countries		25.3%	
Cereals	-42.7	Russia	-55.9%
Wood	-12.7	Saudi Arabia	-14.6
Woven Apparel	-10.3	Japan	- 3.4
Beverages	1.7	Australia	3.9
Vehicles	11.5	Korea	5.0
Aluminum	12.2	Belgium	11.5
Iron & Steel	14.1	Spain	15.3
Inorganic Chemicals; rare	16.3	Brazil	20.1
Iron & Steel Products	22.3	Germany	24.6
Miscellaneous Chemicals	25.4	Italy	25.2
Precious Stones	25.9	Netherlands	32.3
Machinery	29.5	Taiwan	32.4
Organic Chemicals	30.3	Sweden	32.9
Rubber	31.0	Canada	33.1
Copper & Articles	36.5	UK	34.5
Plastic	38.4	China	35.7
Optic/Medical Instruments	47.8	France	40.4
Electrical Machinery	52.4	Mexico	96.8
Pharmaceuticals	88.4	Ireland	111.1

Equations Appendix

Equation (1) decomposes the NRC (in Table 2) into two components: National Coattail and State-Specific

$$(1) \text{ NRC} = \sum X_{i,o}^s (x_i^n - x^n) + \text{National Coattail Industry} + \sum X_{i,o}^s (x_i^s - x_i^n) \text{ State-Specific Industry}$$

Where s is a superscript designating a specific state; n is a superscript denoting the nation; X is the dollar value of exports; x is the growth rate of exports over the entire period of the study (1996-2000); o is a subscript designating the first year of the period of study (1996), and i is a subscript denoting a specific industry.

By adding and subtracting a National Coattail Country Destination to Equation (1) we get an expanded version of equation (1):

$$(2) \text{ NRC} = \sum X_{i,o}^s (x_i^n - x^n) + \text{National Coattail Industry}$$

$$\begin{aligned} & \sum X_{i,o}^s (x_i^n - x^n) + && (see Table 3) + \\ & \sum X_{i,o}^s (x_i^s - x_i^n) - \sum X_{j,o}^s (x_j^n - x^n) && \text{National Coattail Country Destination} \\ & && (see Table 3) + \\ & && \text{State-Specific (See Table 2, column 3) =} \\ & && [\text{State-Specific Industry -} \\ & && (\text{See Table 4}) \\ & && \text{National Coattail Country Destination}] \end{aligned}$$

where j is a subscript representing a country destination.

This third component in equation (2) is what C&P called the Competitive effect.

Equation (1) can be re-written alternatively in the following form that emphasizes country destination rather than industry:

$$\begin{aligned} (3) \text{ NRC (country destination)} &= \sum X_{i,o}^s (x_i^n - x^n) + && \text{National Coattail Country Destination} + \\ & \sum X_{j,o}^s (x_j^s - x_j^n) && \text{State-Specific Country Destination} \\ & && (see Table 4) \end{aligned}$$

We decompose the State-Specific Industry effect in Equation (1) using the following two equations: *(used to choose countries for last column of Table 4)*

$$\begin{aligned} (4a) \sum X_{j,o}^s (x_j^{s-All Industry} - x_j^{s-All Industry}) &&& \text{Industry Country State Coattails} \\ (4b) \sum X_{j,o}^s (x_j^{s-Vehicle} - x_j^{s-All Industry}) &&& \text{Industry Country State-Specific} \end{aligned}$$

Technical Appendix

Introduction

This article attempts to update, extend, and refine the C&P approach so that we can better understand the role of industry, destination, and state competitive factors in determining state export performance. These modifications are designed to better measure and isolate country, industry, and competitive determinants of a state's export sales growth. Our work differs from C&P in the following ways:

- Time period – this paper examines five years from 1996 to 2000. This was a time period of strong U.S. export sales growth, despite a temporary contraction of sales from 1997 to 1998.
- Coverage – we focus our inquiry on 13 selected states, forming a contiguous area surrounding the Midwest.
- Data (industries) – we use more disaggregated industry data organized by Harmonized Tariff Schedule Codes (HS) instead of Standard Industrial Classification Codes (SIC) allowing for a 99-sector breakdown of state industries.

- Data (country destinations) – we analyze all state country destinations rather than an aggregation of destinations by region.
- Method – we generalize the shift-share technique to allow for a richer dichotomy of destination and industry effects.
- Refinement – like C&P we discuss the roles of industry, country, and competitiveness, but our approach allows us to go further qualitatively by analyzing which industries and countries have accounted for each state's export sales growth.

Shift-Share Model

C&P decompose a state's net relative change in export sales growth in two stages. First, they note that NRC equals an industry effect plus a competitive effect, where the industry effect captures the amount of change attributable to the initial industry composition of the state.

Note: The equation numbers in this section generally correspond to those in the Equations section. The main difference is that in this section we use C&P's taxonomy. Below we relate their taxonomy to ours.

$$(1) \text{ NRC} = \sum X_{i,o}^s (\bar{x}_i^n - \bar{x}^n) + \sum X_{i,o}^s (\bar{x}_i^s - \bar{x}_i^n)$$

Where s is a superscript designating a specific state; n is a superscript denoting the nation; X is the dollar value of exports; x is the growth rate of exports over the entire period of the study; o is a subscript designating the first year of the period of study, and i is a subscript denoting a specific industry.

A state will have a large industry effect if its exports in the initial year (1988) were concentrated in industry sectors that showed strong U.S. export sales growth in the subsequent period (1988 to 1998).

The competitive effect measures state economic changes not attributable to national growth – it measures how much the export sales of the state's industries differed from the nation's.

This decomposition focuses exclusively on industry sectors. For example, if a state had very strong growth relative to the nation (a large positive value of NRC; for example New Mexico), this strong export sales growth could be attributable to (1) its initial position with industries whose national export strength turned out to be strong and/or (2) industry sectors that exported at rates much stronger than the nation's. In the case of New Mexico, C&P found that the latter explained the strong export growth. The initial

positioning, in contrast, worked against the strong growth because New Mexico was not well-positioned in 1988 with those industries with strong national export sales growth.

Shift-Share plus Country Destination

C&P recognized that this decomposition ignores the role of export destinations. For example, it is possible that the competitive effect is largely a result of initial positioning in export sales to particular nations. A state may have had large export sales to Germany in the initial time period. If U.S. sales to Germany were very strong in the subsequent time period, the state's early experience with Germany would have given it an advantage.

Inasmuch, in the second stage of the analysis, C&P decompose the competitive effect into a destination effect and a true competitive effect that is net of either the industry or destination impact. [They attribute this innovation to Ricardo Gazel and Keith P. Schwer, "A Measure of Export Similarity and Its Possible Uses," *Economic Journal*, December, 1979, pp 185-204.] This allows them to isolate the contributions of three factors:

$$\begin{aligned}
 (2) \text{ NRC} &= \sum X_{i,o}^s (x_i^n - x_i^n) + && \text{Initial positioning by industry} \\
 &+ \sum X_{i,o}^s (x_i^n - x_i^n) + && \text{Initial positioning by country destination} \\
 &+ \sum X_{i,o}^s (x_i^s - x_i^n) - \sum X_{j,o}^s (x_j^n - x_j^n) && \text{Two-stage competitive effect,}
 \end{aligned}$$

where j is a subscript representing a country destination.

Generalized Shift-Share

While C&P's two-stage decomposition yields additional insights into NRC that stem from country destinations, it leaves out important information. While it is true that C&P calculate a destination impact, it is an incomplete evaluation of the full destination impact for two reasons.

NRC Country Orientation Approach

First, while the C&P two-stage decomposition provides additional destination information, one piece of critical country information remains. To understand, reconsider that the basic shift share model as expressed by Equation (1) emphasizes industry. Instead, we can begin the shift-share analysis with a country destination orientation wherein NRC can be decomposed into two effects:

$$\begin{aligned}
 (3) \text{ NRC (country orientation)} &= \sum X_{i,o}^s (x_i^n - x_i^n) + \sum X_{j,o}^s (x_j^s - x_j^n) \\
 &\text{where } j \text{ refers to country destination.}
 \end{aligned}$$

A state will have a large destination effect if its exports in the initial year were concentrated in country destinations that showed strong U.S. export sales growth in the subsequent period. This is exactly the same as the destination effect in equation (2).

The competitive effect* measures state economic changes above or below national growth – it measures how much the state's growth by destination differed from the nation's. While this seems similar to C&P's competitive effect, it is really quite different since C&P's measures the state's export growth relative to the nation's by industry sector. The country orientation competitive effect* measures it by country destination. This competitive effect* is not captured by C&P.

Applying the Gazel and Schwer modification creates these three effects:

(Note: There is no counterpart to this equation in the Equations Section.)

$$\begin{aligned}
 (4) \text{ NRC (country orientation)} &= \sum X_{i,o}^s (x_i^n - x^n) + && \text{Initial positioning by industry} \\
 &+ \sum X_{i,o}^s (x_i^n - x^n) + && \text{Initial positioning by country destination} \\
 &+ \sum X_{j,o}^s (x_j^s - x_j^n) - \sum X_{i,o}^s (x_i^n - x^n) && \text{Two-stage competitive effect*}
 \end{aligned}$$

Comparing equations (2) and (4) reveals a difference only in the competitive effects. Of particular note is the new term that compares the state country destination growth with the national country destination growth. With equations (2) and (4) we broaden the analysis to include four terms:

- Initial positioning: by (i) industry and (ii) country
- Growth relative to the nation: by (iii) industry and (iv) country

It is very important to stress that the calculated value of our competitive effect* (equation (4)) is exactly the same numerically as C&P's competitive effect (equation (2)). What differs in the two approaches are the insights they provide about the role of particular industries and countries in determining the competitive effect. More is said about this in our next point below.

Within State Analysis

Second, the above procedure – whether by industry or country orientation – provides an incomplete understanding of NRC since both approaches do not explain why particular industry sectors generated a particular competitive impact for a state. For example, suppose a state has a large positive competitive effect because of stronger-than-national export sales of Machinery. Why did this state do so well in Machinery? It is possible to add a third stage to the analysis that answers this question. More specifically, in the third stage, we chose one industry that was most responsible for each state's competitive effect. With respect to that industry in that state, we refined the results into two further aspects:

- Because the industry was positioned well in destinations where all the state's industry sectors exported faster or slower than all country destinations

- Because the industry distinguished itself in destinations compared to all the state's industries

For example, suppose Indiana had a large competitive effect – meaning that Indiana's export industries outperformed the nation's. Suppose this was largely because of very strong export growth from Indiana's Vehicles sector. This final analysis would attribute Indiana's vehicle's performance into two further country factors:

Indiana's vehicles initial country positioning by country:

$$(4a) \sum X_{j,o}^s (x_j^{s-All Industry} - x_j^{s-All Industry})$$

Indiana vehicles growth relative to all Indiana industries growth by country:

$$(4b) \sum X_{j,o}^s (x_j^{s-Vehicle} - x_j^{s-All Industry})$$

Three-Stage Generalized Shift-Share: Analysis of 13 States from 1996 to 2000

By accomplishing the three-stage analysis AND the country orientation approach, we get a more complete view and understanding of a state's export growth, including the six following components (components in *italics* go beyond C&P):

Industry effect (initial industry positioning)
 Destination effect (initial destination positioning)
Competitive effect that includes a destination effect (country destination growth relative to nation's)*
 Competitive effect (industry sector growth relative to the nation)
Because the industry was positioned well in destinations where the state did well
Because the industry did well in destinations compared to all the state's industries

Our generalization requires a need for better and more consistent taxonomy for all these effects that better describes the roles of industry and destination. In the body of the paper, the conversion terms are as follows:

<u>Our terminology</u>	<u>C&P terminology as applied to general model</u>
National Coattails Industry	Industry effect (initial positioning)
National Coattails Country Destination	Destination effect (initial positioning)
State-Specific Industry	Competitive effect (industry orientation)
State-Specific Country Destination	Competitive effect* (country destination orientation)
Industry Country State Coattails	None
Industry Country State Specific	None

¹ "Comparing Manufacturing Export Growth Across States: What Accounts for the Differences?" St. Louis Federal Reserve Bank *Review* (January/February 2001, pp 25-40).

² Ibid, page 39.

³ For more information about C&P's approach and how ours differs, please see the technical appendix.

⁴ C&P called these "Industry Mix" effects, but in our more general approach it makes more sense to call them National Coattails Industry effects.

⁵ C&P called these Destination effects, but as the reader will see below, it makes more sense to call these National Coattails Country Destination effects.